IN THE CLAIMS

Please amend the claims as shown below.

1. (Original) A far-end crosstalk canceling circuit for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols to corresponding network termination modems over a plurality of transmission channels, comprising precompensation means multiplying, before transmission, a vector S = (Si), i = 1 to n, by a precompensation matrix such that the matrix product H*M is diagonal, H being a transfer matrix of the plurality of transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the digital transmission symbols Ri respectively received by the modems.

2. (Original) The far-end crosstalk canceling circuit of claim 1, further comprising:

storing means storing said transfer matrix;

inversion means inverting said transfer matrix and providing the precompensation means with the inverted matrix.

3. (Previously Presented) A far-end crosstalk canceling circuit for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols to corresponding network termination modems over a plurality of transmission channels, comprising precompensation means multiplying, before transmission, a vector S = (Si), i = 1 to n, by a precompensation matrix such that the matrix product H*M is diagonal, H being a transfer matrix of the plurality of transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the digital transmission symbols Ri respectively received by the modems;

further comprising:

storing means storing transfer matrices of the plurality of transmission channels at tones being defined by R(fj)= H(fj)* S(fj), where R(fj) is the vector R(fj)= (Ri(fj)) i = 1 to n and S(fj) is the vector S(fj) = (Si(fj)), i = 1 to n, Ri(fj) and Si(fj) being the components at tone fj of the received discrete multitone symbol Ri and transmitted discrete multitone symbol Si respectively;

and

inversion means sequentially inverting said transfer matrices H(fj) and supplying the precompensation means with an inverted matrices $H^{-1}(fj)$, the precompensation means sequentially calculates the products $H^{-1}(fj)*S(fj)$.

4. (Currently Amended) A far-end crosstalk canceling circuit for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols to corresponding network termination modems over a plurality of transmission channels, comprising precompensation means multiplying, before transmission, a vector S = (Si), i = 1 to n, by a precompensation matrix such that the matrix product H*M is diagonal, H being a transfer matrix of the plurality of transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the digital transmission symbols Ri respectively received by the modems; and

a digital subscriber line transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, comprising:

the far-end crosstalk canceling circuit canceling far-end crosstalk at the network termination side of said system; and

a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the line termination side of said system by estimating [[the]] <u>an</u> inverse of the transfer matrix H^{-1}_{up} of the plurality of the transmission channels in [[the]] <u>an</u> upstream direction, said line termination far-end crosstalk canceling circuit supplying [[the]] storing means of said far-end crosstalk canceling circuit with $H= H^{-1}_{up}$.

5. (Previously Presented) A digital subscriber line transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, comprising:

a far-end crosstalk canceling circuit according to claim 3 canceling far-end crosstalk at the network termination side of said system; and

a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the

line termination side of said system by estimating the inverse of the transfer matrices $H^{-1}{}_{up}(fj)$ of the plurality of transmission channels in the upstream direction at tone fj, said line termination far-end crosstalk canceling circuit supplying the storing means of said far-end crosstalk canceling circuit with $H(fj) = H^{-1}{}_{up}(fj)$.

6. (Original) A digital subscriber line transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, further comprising a far-end crosstalk canceling circuit according to claim 3 canceling far-end crosstalk at the network termination side of said system;

each LT modem comprises inserting means for inserting at predetermined times known symbols P(i,fj) as components at tone fj of multitone symbols Si;

each network termination modem comprises means for detecting at said predetermined times the components Rk(fj) and for deriving therefrom the coefficients $H_{ik}(fj)$ of the transfer matrix H(fj);

each network termination modem further comprises a multiplexer for multiplexing data to be transmitted with said coefficients $H_{ik}(fj)$;

each line termination modem further comprises a demultiplexer for extracting from the received data said coefficients $H_{ik}(fj)$.

7. (Original) A far-end crosstalk canceling method for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, wherein a vector S = (Si), i = 1 to n, is multiplied, before transmission, by a precompensation matrix M such that the matrix product H*M is diagonal, H being a transfer matrix of the n transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the discrete multitone symbols Ri respectively received by the modems.

8. (Original) The far-end crosstalk canceling method of claim 7, wherein:

said transfer matrix is stored in storing means;

said transfer matrix is then retrieved and inverted; and

the inverted matrix is used as precompensation matrix M.

9. (Previously Presented) A far-end crosstalk canceling method for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, wherein a vector S = (Si), i = 1 to n, is multiplied, before transmission, by a precompensation matrix M such that the matrix product H*M is diagonal, H being a transfer matrix of the n transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the discrete multitone symbols Ri respectively received by the modems;

wherein:

transfer matrices H(fj) of the n transmission channels at tones fj are stored in storing means, H(fj) being defined by R(fj) = H(fj)* S(fj) where R(fj) is the vector R(fj) = (Ri(fj)), i = 1 to n, and S(fj) is the vector S(fj) = (Si(fj)), i = 1 to n, Ri(fj) and Si(fj) being the components at tone fj of the received discrete multitone symbol Ri and transmitted discrete multitone symbol Si respectively;

said transfer matrices H(fj) are retrieved and inverted;

the inverted matrices H^{-1}(fj) are used as precompensating matrices at tones fj.

10. (Original) The far-end crosstalk canceling method of claim 9, wherein:

for each line termination modem, known symbols P(i,fj) are inserted at predetermined times as components at tone fj of multitone symbols Si;

for each network termination modem, the components Rk(fj) are detected at said predetermined times, the coefficients H_{ik}(fj) of transfer matrix H(fj) are derived therefrom and multiplexed with the data to be transmitted;

for each modem, said coefficients H_{ik}(fj) are extracted from the received data.

11. (Previously Presented) The far-end crosstalk canceling circuit according to claim 2 wherein said storing means is organized in planes.

12. (Previously Presented) A far-end crosstalk canceling circuit for a data transmission system comprising a precompensation circuit multiplying, before transmission, a vector S = (Si), i = 1 to n, by a precompensation matrix such that the matrix product H*M is diagonal, H being a transfer matrix of a plurality of transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the digital transmission symbols Ri respectively received by a modem.

13. (Previously Presented) The far-end crosstalk canceling circuit of claim 12, further comprising:

a storage circuit storing said transfer matrix;

an inversion circuit inverting said transfer matrix and providing the precompensation circuit with the inverted matrix.

14. (Previously Presented) The far-end crosstalk canceling circuit according to claim 13 wherein said storage circuit is organized in planes.

15. (Previously Presented) A far-end crosstalk canceling circuit for a data transmission system comprising a precompensation circuit multiplying, before transmission, a vector S = (Si), i = 1 to n, by a precompensation matrix such that the matrix product H*M is diagonal, H being a transfer matrix of the plurality of transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the digital transmission symbols Ri respectively received by a modem;

further comprising:

a storage circuit storing transfer matrices of the plurality of transmission channels at tones being defined by R(fj)= H(fj)* S(fj), where R(fj) is the vector R(fj)= (Ri(fj)) i = 1 to n and S(fj) is the vector S(fj) = (Si(fj)), i = 1 to n, Ri(fj) and Si(fj) being the components at tone fj of the received discrete multitone symbol Ri and transmitted discrete multitone symbol Si respectively; and

an inversion circuit sequentially inverting said transfer matrices H(fj) and supplying the

precompensation circuit with the inverted matrices $H^{-1}(fj)$, the precompensation circuit sequentially calculating the products $H^{-1}(fj)*S(fj)$.

16. (Currently Amended) A far-end crosstalk canceling circuit for a data transmission system comprising a precompensation circuit multiplying, before transmission, a vector $S = (Si)$, $i = 1$ to n, by a precompensation matrix such that the matrix product $H*M$ is diagonal, H being a transfer matrix of a plurality of transmission channels defined by $R = H*S$, where $R = (Ri)$, $i = 1$ to n, is the vector of the digital transmission symbols Ri respectively received by a modem; and

a data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, comprising:

a far-end crosstalk canceling circuit, canceling far-end crosstalk at the network termination side of said system; and

a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the line termination side of said system by estimating [[the]] <u>an</u> inverse of the transfer matrix H^{-1}_{up} of the plurality of the transmission channels in [[the]] <u>an</u> upstream direction, said line termination far-end crosstalk canceling circuit supplying [[the]] <u>a</u> storage circuit of said far-end crosstalk canceling circuit with $H= H^{-1}_{up}$.

17. (Previously Presented) A data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, comprising:

a far-end crosstalk canceling circuit according to claim 15 canceling far-end crosstalk at the network termination side of said system; and

a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the line termination side of said system by estimating the inverse of the transfer matrices $H^{-1}_{up}(fj)$ of the plurality of transmission channels in the upstream direction at tone fj, said line termination far-end crosstalk canceling circuit supplying the storage circuit of said far-end crosstalk canceling circuit with $H(fj) = H^{-1}_{up}(fj)$.

18. (Previously Presented) A data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, further comprising a far-end crosstalk canceling circuit according to claim 15 canceling far-end crosstalk at the network termination side of said system, wherein:

each LT modem comprises an insertion circuit for inserting at predetermined times known symbols P(i,fj) as components at tone fj of multitone symbols Si;

each network termination modem comprises a detection circuit for detecting at said predetermined times the components Rk(fj) and for deriving therefrom the coefficients $H_{ik}(fj)$ of the transfer matrix H(fj);

each network termination modem further comprises a multiplexer for multiplexing data to be transmitted with said coefficients $H_{ik}(fj)$; and

each line termination modem further comprises a demultiplexer for extracting from the received data said coefficients $H_{ik}(fj)$.

19. (Previously Presented) A far-end crosstalk canceling method for a data transmission system, said data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, wherein a vector S = (Si), i = 1 to n, is multiplied, before transmission, by a precompensation matrix M such that the matrix product H*M is diagonal, H being a transfer matrix of the n transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the discrete multitone symbols Ri respectively received by the modems.

20. (Previously Presented) The far-end crosstalk canceling method of claim 19, further comprising:

inverting the transfer matrix H to produce the precompensation matrix M.

21. (Previously Presented) A far-end crosstalk canceling method for a data transmission system, said data transmission system comprising a plurality of line termination

modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, wherein a vector S = (Si), i = 1 to n, is multiplied, before transmission, by a precompensation matrix M such that the matrix product H*M is diagonal, H being a transfer matrix of the n transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the discrete multitone symbols Ri respectively received by the modems; and

further comprising:

for transfer matrices H(fj) of the n transmission channels at tones fj , H(fj) being defined by R(fj) = H(fj)* S(fj) where R(fj) is the vector R(fj) = (Ri(fj)), i = 1 to n, and S(fj) is the vector S(fj) = (Si(fj)), i = 1 to n, Ri(fj) and Si(fj) being the components at tone fj of the received discrete multitone symbol Ri and transmitted discrete multitone symbol Si respectively,

inverting the transfer matrices H(fj) to produce inverted matrices H^{-1}(fj), which are used as precompensating matrices at tones fj.

22. (Previously Presented) The far-end crosstalk canceling method of claim 21, further comprising:

inserting known symbols P(i,fj) at predetermined times as components at tone fj of multitone symbols Si;

detecting the components Rk(fj) at said predetermined times, the coefficients H_{ik}(fj) of transfer matrix H(fj) being derived therefrom and multiplexed with the data to be transmitted; and

extracting said coefficients H_{ik}(fj) from the received data.

23. (Previously Presented) A modem comprising a far-end crosstalk canceling circuit, said far-end crosstalk canceling circuit comprising a precompensation circuit multiplying, before transmission, a vector S = (Si), i = 1 to n, by a precompensation matrix such that the matrix product H*M is diagonal, H being a transfer matrix of a plurality of transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the digital transmission symbols Ri respectively received by the modem.

24. (Previously Presented) The modem of claim 23, wherein the far-end crosstalk

canceling circuit further comprises:

a storage circuit storing said transfer matrix;

an inversion circuit inverting said transfer matrix and providing the precompensation circuit with the inverted matrix.

25. (Previously Presented) The far-end crosstalk canceling circuit according to claim 24 wherein the storage circuit is organized in planes.

26. (Previously Presented) A modem comprising a far-end crosstalk canceling circuit, said far-end crosstalk canceling circuit comprising a precompensation circuit multiplying, before transmission, a vector $S = (Si)$, $i = 1$ to n, by a precompensation matrix such that the matrix product $H*M$ is diagonal, H being a transfer matrix of a plurality of transmission channels defined by $R = H*S$, where $R = (Ri)$, $i = 1$ to n, is the vector of the digital transmission symbols Ri respectively received by a modem;

wherein the far-end crosstalk canceling circuit further comprises:

a storage circuit storing transfer matrices of the plurality of transmission channels at tones being defined by $R(fj)= H(fj)* S(fj)$, where $R(fj)$ is the vector $R(fj)= (Ri(fj))$ $i = 1$ to n and $S(fj)$ is the vector $S(fj) = (Si(fj))$, $i = 1$ to n, $Ri(fj)$ and $Si(fj)$ being the components at tone fj of the received discrete multitone symbol Ri and transmitted discrete multitone symbol Si respectively; and

an inversion circuit sequentially inverting said transfer matrices $H(fj)$ and supplying the precompensation circuit with the inverted matrices $H^{-1}(fj)$, the precompensation circuit sequentially calculating the products $H^{-1}(fj)*S(fj)$.

27. (Previously Presented) The far-end crosstalk canceling circuit according to claim 26 further comprising a counting circuit for performing frequency-time signal transformation.

28. (Canceled)

29. (Previously Presented) A data transmission system comprising a plurality of line

transmission modems transmitting discrete multitone symbols Si to corresponding network termination modems over n transmission channels, including means for precompensating for far-end crosstalk;

wherein the means for precompensating for far-end crosstalk further comprise means for multiplying, before transmission, a vector S = (Si), i = 1 to n, by a precompensation matrix M such that the diagonal of the product equals H*M, where H is a transfer matrix of the plurality of transmission channels defined by R = H*S, where R = (Ri), i = 1 to n, is the vector of the digital transmission symbols Ri respectively received by the modems.

30. (Previously Presented) The data transmission system according to claim 29, further comprising means for estimating an inverse H^{-1}_{up} of the transfer matrix H_{up} of the n transmission channels.

31. (Previously Presented) The data transmission system according to claim 30, further comprising means for storing H^{-1}_{up}.

32. (Previously Presented) The data transmission system according to claim 29, further comprising means for storing transfer matrices of the plurality of transmission channels at tones being defined by R(fj)= H(fj)* S(fj), where R(fj) is the vector R(fj)= (Ri(fj)) i = 1 to n and S(fj) is the vector S(fj) = (Si(fj)), i = 1 to n, Ri(fj) and Si(fj) being the components at tone fj of the received discrete multitone symbol and transmitted discrete multitone symbol respectively.

33. (Previously Presented) The data transmission system according to claim 32, further comprising means for sequentially inverting said transfer matrices H(fj) and supplying said means for precompensating with the inverted matrices H^{-1}(fj) for sequential calculation of the products H^{-1}(fj)*S(fj).

34. (Previously Presented) The data transmission system of claim 33 further comprising:

means for inserting at origin at predetermined times known symbols P(i,fj) as

components at tone fj of multitone symbols Si;

means for detecting at destination at said predetermined times the components Rk(fj) and for deriving therefrom the coefficients $H_{ik}(fj)$ of the transfer matrix H(fj);

means for multiplexing data to be transmitted from destination to origin with the coefficients $H_{ik}(fj)$; and

means for extracting from the data received at origin said coefficients $H_{ik}(fj)$.